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The potential impact of microbicides in Johannesburg, South Africa: model projections and implications for product promotion

Background

There were five million HIV infections in 2002. Of these new infections, three and a half million were in sub-Saharan Africa and 58% of those were among women. Many women have no access to or control over using current prevention options. If the vaginal microbicides currently being developed are shown to be effective against HIV, they would offer women the choice of a significant new prevention option.

Until specific products have completed phase III clinical trials and start to be distributed it is hard to know what impact an efficacious microbicide may have on the HIV epidemic in different settings. In practise, the impact of a microbicide will depend upon context specific factors such as the current level of HIV infection, the underlying patterns of sexual behaviour and condom use, the degree to which a microbicide reduces the probability of HIV and STI transmission, and the extent to which people use microbicides in different partnerships. A microbicide's impact will also be influenced by programme specific factors, including the levels of microbicide distribution.

Mathematical modelling, in combination with site-specific data, can be used to project the extent to which a microbicide will reduce HIV transmission in different settings, and to identify key factors influencing their impact. This briefing note summarises key findings from a modelling exercise that estimates the impact of a partially effective microbicide that is made widely accessible in Hillbrow, an inner city area of Johannesburg.



Box: Key findings

- o A relatively low efficacy microbicide could still impact on HIV incidence even in a high prevalence and incidence setting such as Hillbrow, Johannesburg.
- o A microbicide of 40% HIV and STI efficacy can reduce the district's overall HIV incidence by 9% if it is used by 75% of the district's population in 50% of non-condom protected acts. This also assumes that microbicide users reduce their level of condom use by 5% (5% condom migration). This translates into 784 HIV infections averted over 4 years.
- o The degree of impact achieved is determined by the level of distribution of the microbicide - at low coverage microbicides will still avert HIV infections, but will not greatly affect the evolution of the epidemic.
- o In this setting, given the current distribution of HIV and patterns of condom use, the majority of HIV infections averted will be in casual and primary partnerships. As condom use is relatively high in commercial sex, microbicides are unlikely to avert substantial infection in commercial sex.
- o Condom migration will only be a potential concern among partnerships with high levels of condom use.
- o The earlier a microbicide is introduced into an epidemic, the larger its overall impact.
- o Microbicides should primarily be promoted for use in established casual and long-term stable partnerships, where condom use is generally quite low. Methods of best doing this need to be identified.

Setting the scene: HIV in Hillbrow, Johannesburg

The community of Hillbrow has an adult population of approximately 50,000. Approximately a fifth of the sexually active population report having a current casual partner, and sex work is also relatively common. There is a strong existing HIV prevention intervention, and although sex workers report having a high number of clients per week, condom use is high with paying clients (83-88% of last sex acts), but much lower amongst other sexual partners (41% report not using condoms in last month). Likewise, reported condom use amongst the general population is low (>37% report not using a condom in last month). The prevalence of HIV is high in Hillbrow, in 2001 approximately 30% of antenatal clinic clients [1] and 60% of sex workers were infected [2]. Other STIs are also common - in 1998 24% of female family planning clients and 39% of sex workers were infected with chlamydia and/or gonorrhoea [3].

Methods and aims of analysis

For the analysis we consider the introduction of a 40% HIV and STI efficacious microbicide (approximately half as efficacious as a condom) that is used in 50% of non-condom protected sex acts, and assume that microbicide use results in a 5% reduction in condom use (condom migration). The impact of microbicide use is simulated using a dynamic mathematical model with site specific data, fitted to locally available epidemiological data. The model is used to explore how impact estimates are influenced by the patterns of microbicide use, the potential reduction in condom use that may occur among microbicide users, and to explore how the projections vary if the microbicide had been available earlier on in the HIV epidemic.

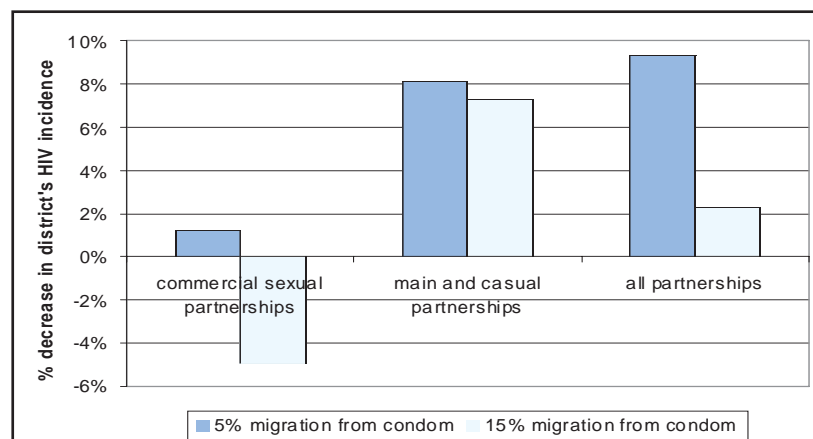
Will a microbicide have an impact in this setting, where HIV is spreading rapidly?

Although HIV infection is widespread and continues to spread rapidly in this setting, the model projects that the microbicide will result in a 9% decrease in the district's HIV incidence, from 6.0 to 5.1 per 100 person years. This translates into 784 HIV infections averted over 4 years, with the vast majority of infections being averted amongst main and casual partnerships (79%). For comparison, if condom use had increased up to this level then there would have been 24% decrease in incidence. Thus, in this setting a microbicide that is half as efficacious as a condom achieves 39% of the impact of the condom.

How may reductions in condom use affect a microbicide's impact?

The impact projections above assumed that microbicide use resulted in a 5% reduction in the consistency of condom use (condom migration). In this case, the microbicide still had a demonstrable impact on HIV transmission. However, it is also possible that microbicide use could result in either more or less condom migration. Figure 1 shows how the impact estimates change for different levels of condom migration.

Figure 1: Affect of 5% and 15% condom migration on the impact of microbicide use in Hillbrow, among different types of sexual partnership*.



*As before, this analysis assumes 75% of the population has access to microbicides, microbicides are used in 50% of non-condom protected sex acts, and the microbicide is 40% efficacious against HIV and STDs.

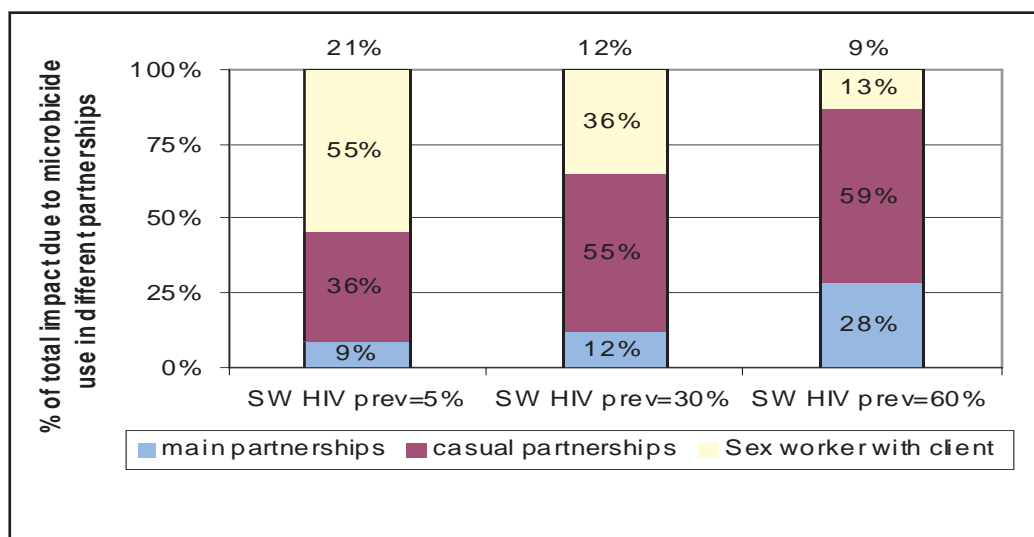
In Hillbrow more than 80% of commercial sex acts are protected by a condom, and so the impact of microbicide use in commercial sex partnerships is very sensitive to the amount of condom migration - with a 15% reduction resulting in a 5% increase in HIV incidence. In contrast, 15% condom migration has little effect on impact in primary and casual partnerships, as the level of condom use is low in these partnerships (less than 25% consistency). These findings highlight that care should be taken in promoting microbicides in contexts where condoms are being used with high consistency, such as sex between a sex worker and client.

How does impact change if microbicides are used in different types of partnership?

The baseline impact estimates assume that the microbicide is used in 50% of non-condom protected sex acts. If the microbicide were used in 25% or 75% of non-condom protected sex acts then there would have been a 2.5% or 16.0% reduction in the district's HIV incidence respectively.

It is probable that microbicides will be used with varying consistency in different types of partnership, and that impact will vary for different stages of an epidemic. For different stages of the HIV epidemic in Hillbrow, Figure 2 shows the projected impact of microbicide use in different types of partnership, relative to if it had been used in all partnerships.

Figure 2: The relative impact of using a microbicide (40% HIV and STI efficacy) in specific types of partnership compared to using it in all partnerships, for different sex worker HIV prevalences. The numbers (%) above each column is the % reduction in HIV incidence when the microbicide is used in all partnerships*.



*As before, this analysis assumes 75% of the population has access to microbicides, microbicides are used in 50% of non-condom protected sex acts, microbicide use results in a 5% relative reduction in condom use and the microbicide is 40% efficacious against HIV and STIs.

Figure 2 shows that in the early stages of the HIV epidemic in Hillbrow, the greatest impact is attained via use of microbicides by men with sex workers, whereas at high HIV prevalences the impact primarily comes from use of microbicides in casual and main partnerships. The figure also shows that the reduction in HIV incidence resulting from microbicide use in all sexual partnerships is greater in the early stages of the HIV epidemic, with the decrease in incidence reducing from over 20% at a sex worker HIV prevalence of 5% to less than 10% at the current sex worker HIV prevalence of 60%.

Conclusions

This analysis shows that microbicide use could significantly reduce HIV transmission in a high HIV prevalence setting such as Hillbrow, Johannesburg. However, even though restricted use would still avert infections and save lives, wide-

spread access and use is required for a microbicide to result in a significant reduction in HIV incidence. The results emphasise the importance of promoting microbicide use in partnerships where condoms are not normally used, especially amongst casual and regular partnerships. Care should be taken in promoting microbicide use in sexual partnerships that have high condom use, such as amongst commercial sex partnerships, because condom migration could easily negate the beneficial effects of a microbicide.

Our results also show that a microbicide would have a greater impact on HIV transmission in the earlier stages of the type of HIV epidemic that occurred in Hillbrow. The relative impact of microbicide use in different types of partnership also changes as an epidemic progresses. Early on most impact is attained within sex worker and client partnerships whereas later on most impact comes from casual and primary partnerships. However, even in settings where HIV is mainly concentrated among the most vulnerable groups, care should be taken in microbicide promotion. As condom use is often high in commercial sexual partnerships, migration can easily cause problems. For this reason, care should be taken when considering the marketing and placement of microbicides, and the way they are perceived. Although in many circumstances they should not be promoted for commercial sex, they may still be important for sex workers to use with their non-commercial partners where condom use is typically low. In casual partnerships they could potentially be promoted as an adjunct to condoms or something to be used if condoms prove impossible. Given the difficulty of achieving consistent condom use in primary partnerships, microbicides should be strongly promoted.

Recommendations

- o Even in settings where HIV is widespread many people are not using condoms consistently. Alternatives are urgently needed.
- o Microbicides could significantly reduce HIV transmission if inconsistent and non-condom users find them easy to use - and so even in product development it is important to identify what programmatic and product related characteristics may affect whether they will eventually be widely available and used.
- o No one method of HIV protection provides the solution to the HIV epidemic. Particularly where HIV infection is widespread, many complementary methods of protection are needed.
- o In advocacy and education activities care must be

taken to present microbicides as a method to complement and enhance other prevention activities

- o If an effective microbicide is developed then the product should be made available as an over the counter product as quickly as possible, as the effectiveness of the method is directly related to its ease of access and thus consistency of use.
- o Microbicides should primarily be promoted for use in established casual and long-term stable partnerships, where condom use is generally quite low. Methods of best doing this need to be identified.

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